



Adaptive procedural generation in Minecraft

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- Hilly terrain

04.

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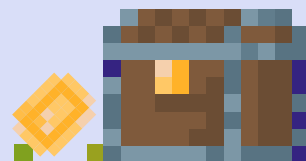


Motivation & Goals



Write a procedure to generate a settlement/village in Minecraft

- Main Points:
 - Be able to build anywhere
 - Adapt to landscape
 - Look natural & realistic
 - Be useable by a player

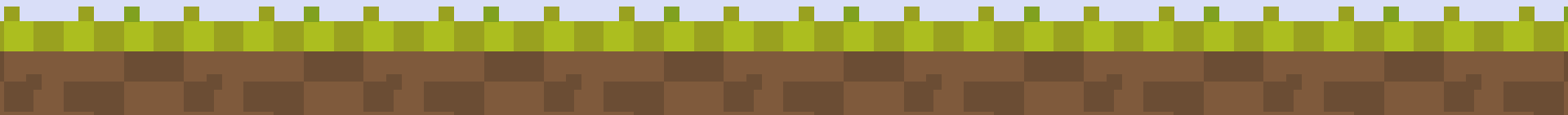




Challenges



This is what Minecraft's default NPC villages are supposed to look like...

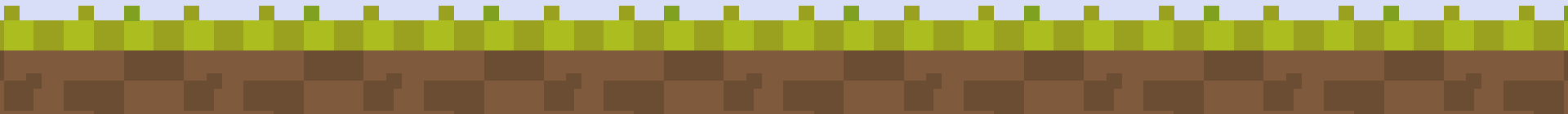




Challenges

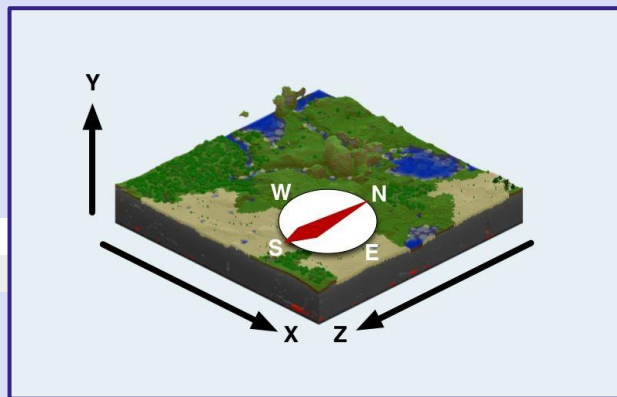


But this is often how the village procedural generation ends up looking

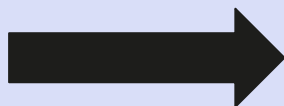




Methodology: Terraforming



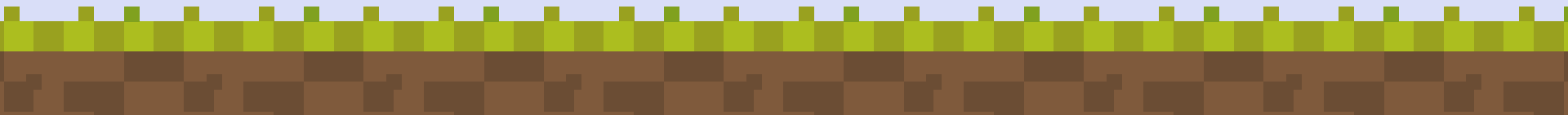
Flatten



```
[[48, 46, 46, 45, 53],  
 [45, 46, 46, 45, 63],  
 [43, 43, 45, 45, 46],  
 [44, 51, 46, 47, 53],  
 [45, 50, 51, 52, 51]]
```

ex: A 5x5
heightmap

Consider a 128 block radius: Worst case search
~16,000 blocks instead of ~2.1 million





Methodology: Terraforming



- Breadth first search of heightmap with observation
- Uses result of search to clear trees



Methodology: Plot Analysis

How to determine ideal house placements?

Current Approach: Calculating standard deviations of height in subgrids

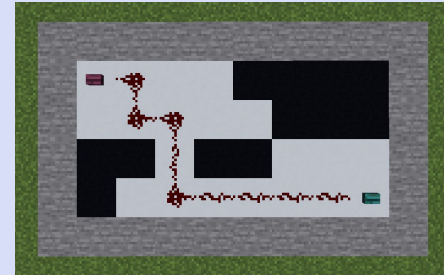
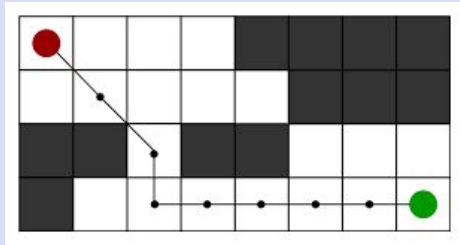
Considering: Modified Moore Neighborhood edge detection

	NW	N	NE	
	W	C	E	
	SW	S	SE	



Methodology: Road Building

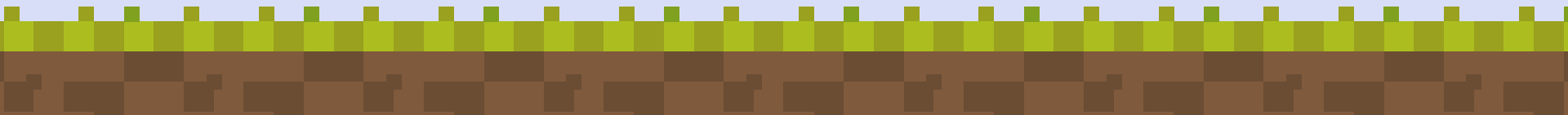
Modified A*





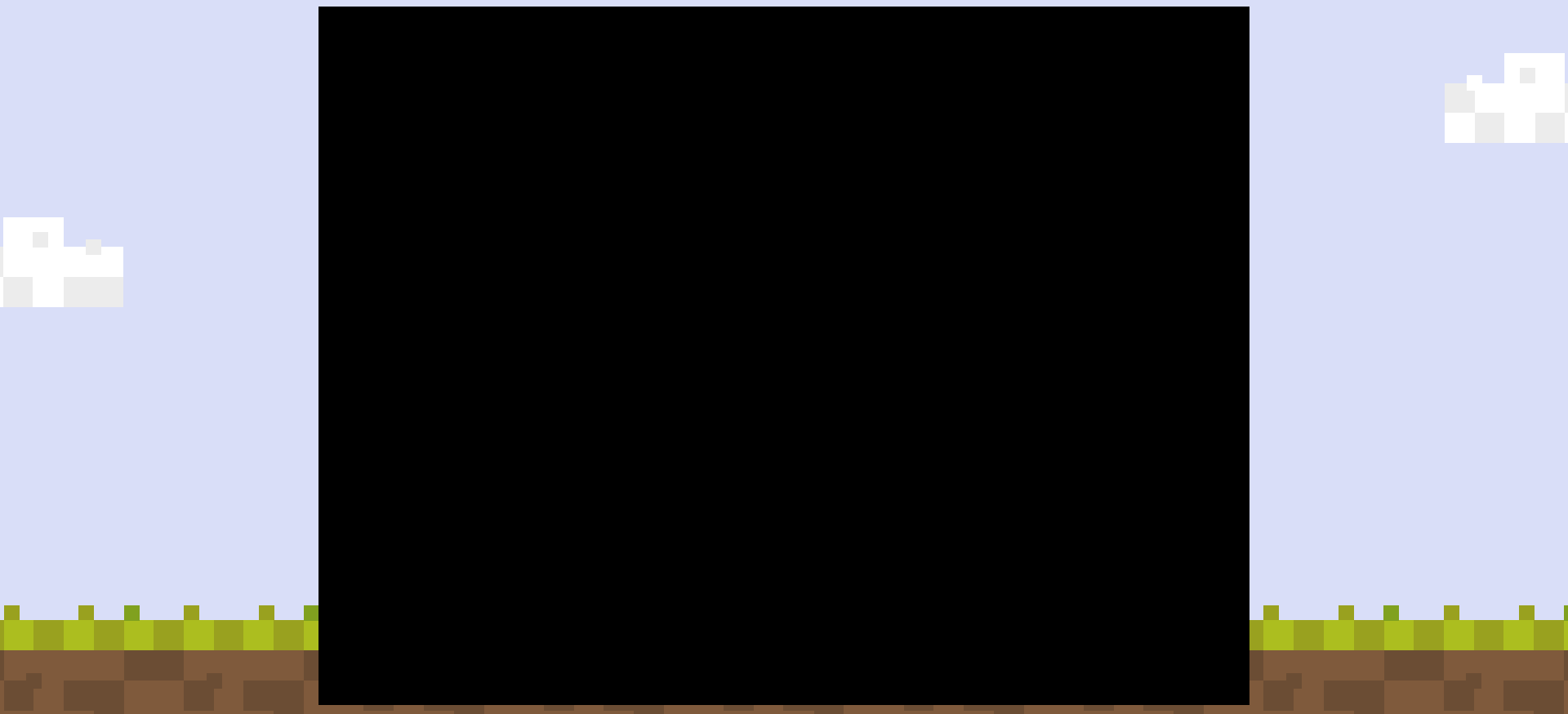
Methodology: Road Building

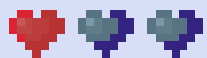
Using Height as Boundaries



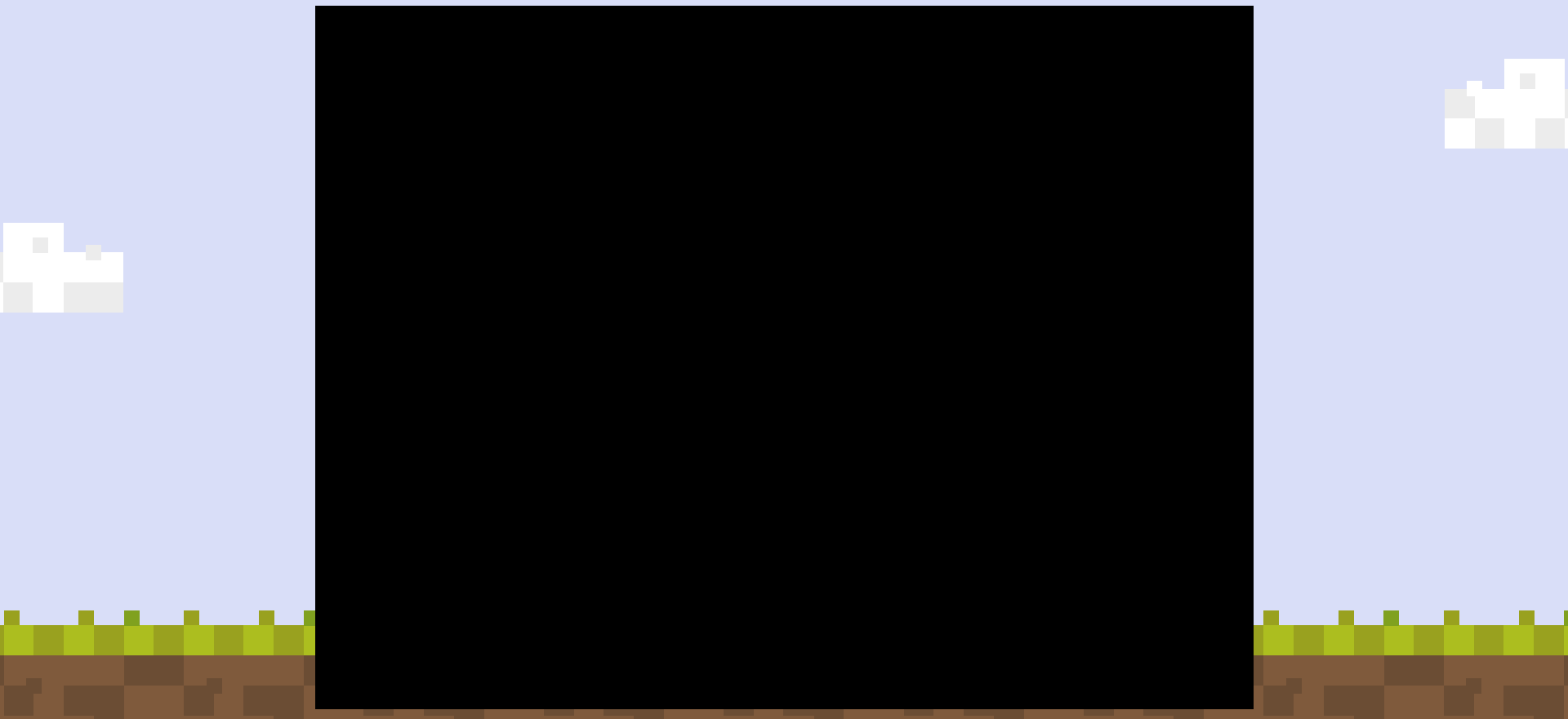


Demo 1: Flat Terrain





Demo 2: Hilly Terrain



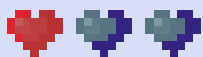


Challenges Faced

HTTP Connection Errors

Deciding How to Partition Land

...



Alternative Approaches

Machine Learning - DNN

Binary Space Partitioning

...



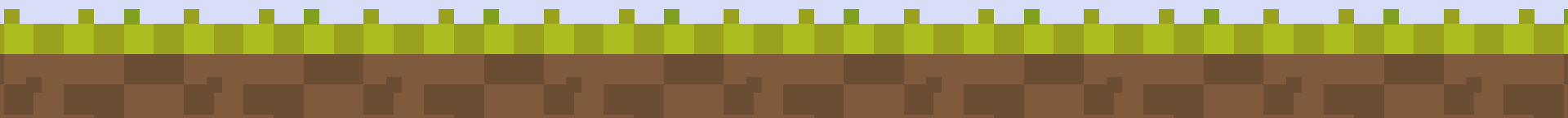
Next Steps

Smart House Construction

Introducing New Structure Types
(bridges, tunnels, etc.)

Changing Settlement Based on
Different Factors (Bayesian
Network)

...





Thanks for listening!

Questions?

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